PARASITISM OF *ACACICOLA ORPHANA* (ERICHSON) (COLEOPTERA: CHRYSOMELIDAE) IN TASMANIA

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Abstract

Parasitism of late-instar *Acacicola orphana* larvae was assessed at six locations throughout Tasmania in October 1997. Overall rates of parasitism were very low and only one parasitoid was collected, a species of *Lixophaga* Townsend (Diptera: Tachinidae). Only 17 tachinid pupae were reared from 600 larvae (2.83% parasitism), but the number of larvae initially observed bearing tachinid eggs was higher (32 larvae, 5.3% parasitism). The emergence rate of adult tachinids was low, with only four of the 17 pupae (23%) yielding flies. The number of larvae bearing tachinid eggs between sites ranged from 0-17 and was positively and significantly correlated with tree damage estimates made at the collection sites during the previous season.

Introduction

The fireblight beetle, *Acacicola* (= *Pyrgoides*) *orphana* (Erichson), defoliates the temperate bipinnate acacias *Acacia dealbata* Link. and *A. mearnsii* de Wild (French 1911, Froggatt 1923, McKeown 1942). Defoliation is more apparent in spring when the winter-developing larvae are in the fourth (final) instar. Severely affected trees can lose all foliage and larvae chew green bark from the stems, effectively ring-barking the trees. Repeated severe defoliation may result in tree death. Although *A. dealbata* and *A. mearnsii* have been identified as having potential for pulp and paper making (Clark *et al.* 1994), there is a reluctance to grow these species because of the severe defoliation caused by *A. orphana* (D. de Little, pers. comm.).

An understanding of the natural enemies of *A. orphana* is needed if IPM systems are to be developed for this insect. Elliott (1978) observed only very low numbers (6 specimens from 'a number of collections ... containing several hundred individuals per collection') of two tachinid parasitoids, *Deltomyza australiensis* (Malloch) and a species of *Lixophaga* Townsend in *A. orphana* populations in the Florentine Valley, south-central Tasmania. Elliott (1978) noted that *A. orphana* larvae develop throughout the colder months of the year and he hypothesised that conditions in his study area were unfavourable for many predators and parasitoids. In 1997 we conducted a more extensive Tasmanian survey of *A. orphana* larval populations, with the aim of identifying additional parasitoid species and spatial variance in parasitism rates.

Materials and methods

No parasitism of eggs, first or second instar larvae of *A. orphana* has been observed (Elliott 1978, T. Simmul, pers. obs.). Therefore, for this study only

third and fourth instar larvae were collected from six Tasmanian sites on one occasion each in mid-October, 1997. Site locations were: Lake Leake (147°38'S, 41°58'E), Buckland 1 (147°44'S 42°39'E), Buckland 2 (147°36'S 42°38'E), Conara (147°27'S 41°50'E), Dromedary (147°06'S 42°46'E) and Perth (147°09'S 41°35'E). At all sites *A. dealbata* was the predominant *Acacia* species. During October 1996 (the previous season), all sites except Dromedary were assessed for *A. orphana* defoliation using a visual scoring system based on 10 trees per site. To obtain the site score, 10 trees were scored visually with values ranging from zero, representing no damage, to five, for complete foliage removal and some bark chewed. The values were then averaged across the 10 trees and rounded to the nearest whole number.

When cultures were first established, each larva was examined individually and records made of any tachinid eggs present on the body. One hundred larvae from each site were maintained in ventilated containers under constant conditions (17°C ± 5°C; 8L, 16D, ~66% R.H.). Cultures were cleaned and fresh foliage was provided three times weakly. At these times any dead larvae were counted and the apparent cause of death noted. Final counts were made of the number of adult beetles, number of parasitoid pupae and the number of adult parasitoids emerging.

The relationship between the number of larvae carrying tachinid eggs and the defoliation score during the previous season was examined using linear regression (Excel 6.0).

Results

Only 5.3% of collected *A. orphana* larvae bore tachinid eggs, with one to three eggs found per individual. A few tachinids (0.5%) developed in larvae with no eggs on the cuticle, implying that the eggs had been dislodged after the tachinid larva eclosed or that the parent fly had oviposited on an earlier instar host. The tachinid was a larval endoparasitoid, killing the host late in the final larval or prepupal stage, when the puparium protruded from a split in the host's cuticle. Adult flies, identified as *Lixophaga* sp., emerged after approximately 10 days. Only one tachinid developed in each host larva. Parasitised *A. orphana* larvae did not appear to behave differently from non-parasitised larvae.

The highest amount of parasitism was at Conara (17% of larvae carrying eggs), while the lowest was 1% at Perth and Buckland 2. At Perth, no egg was observed on the larva; however a single tachinid puparium was observed. No flies were reared from either of these locations (Table 1). Unidentified mortality in the cultures caused losses of 18-27% (average 24%), some of which may have been caused by parasitoids which subsequently failed to emerge. From all collections only 17 tachinid pupae were recorded, from which only four adult flies emerged. No hyperparasitoids were observed.

A positive relationship (r = 0.96) existed between the site defoliation scores made in the season prior to the collections and the number of eggs found on the larvae in 1997.

Table 1. Tree defoliation scores and *Acacicola orphana* larval parasitism records for six sites in Tasmania. Initial sample size from each site = 100 larvae. Defoliation score range: 0 = none; 5 = total defoliation.

Site	Site defoliation score	No. of larvae carrying tachinid eggs	No. of larvae with a tachinid pupa	No. of adult flies emerging from pupae
Lake Leake	2	2	3	2
Conara	5	17	6	2
Buckland 1	3	8	2	0
Buckland 2	1	1	0	0
Perth	0	0	1	0
Dromedary	-	4	5	0

Discussion

In a collection of 600 larvae from six sites, larval parasitism (based on the presence of tachinid eggs) of *A. orphana* in Tasmania, averaged across all sites, was only 5%. Direct mortality attributable to parasitism was around 3%. This parasitism rate seems similar to that obtained by Elliott (1978), although a direct comparison is difficult because of the way his results are presented. Unlike Elliott, only one parasitoid species, *Lixophaga* sp., was obtained. Although other authors have recorded very low parasitism rates of paropsine chrysomelids (the group to which *A. orphana* belongs), tachinid parasitism rates of species such as *Chrysophtharta bimaculata* (Olivier) and *Paropsis atomaria* Olivier are normally 2-7 fold higher than that recorded for *A. orphana* (Tanton and Khan 1978, de Little 1982, Tanton and Epila 1984, de Little *et al.* 1990). The reason for the low parasitism obtained may be due to the winter cycle of *A. orphana* larvae, as suggested by Elliott (1978), but this is difficult to test directly. Alternatively, a greater temporal sampling of larvae may show seasonal cycles in parasitism rates, of which we have only recorded the low period. Seasonality of tachinid parasitism rates has been demonstrated for *P. atomaria* (Tanton and Khan 1978, Tanton and Epila 1984).

If the level of tree defoliation is related to *A. orphana* population levels, this may imply delayed density dependence between beetle numbers and parasite numbers. Obviously the sample size is very low and this needs to be repeated.

The low parasitism rate, coupled with the low number of adult flies successfully developing and emerging from *A. orphana* larvae, suggests that

this species may be a relatively poor host for *Lixophaga* sp. More studies on field parasitism are required to quantify the effect of this parasitoid on populations of *A. orphana*.

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